Small-Signal Characterization of Photonic Crystal Lasers

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We report on the experimental characterization of the dynamic properties of 2-D photonic crystal lasers bonded to sapphire. These structures are of great interest for integrated optics because of their relatively small size. The dynamic properties of the lasers are important not only from a system level point of view, but also because they contain information about how these microcavities modify emission.

Our structures are formed in an InGaAsP membrane bonded to sapphire [1]. We have investigated devices that are between 3.2μm to 4.5μm in diameter and operate under continuous pumping conditions at room temperature. We have measured the laser linewidth using a self-delayed optical homodyne approach, and have obtained the expected $1/P_{out}$ behavior. We have also demonstrated small-signal modulation responses with 3 dB frequencies in excess of 8 GHz in these lasers. Finally, as a part of this investigation, we have measured the linewidth enhancement factor by dispersive propagation in an optical fiber [2].

[1] J. R. Cao, W. Kuang, Z.-J. Wei, S.-J. Choi, H Yu, M.Bagheri, John D. O'Brien, and P. Daniel Dapkus, "Sapphire Bonded Photonic Crystal Micro Cavity Laser", IEEE Photonics Technology Letters 17(1**)**, 4, (2005)

[2] Jianmin Wang, Klaus Peterman, " Small-Signal Analysis for Dispersive Optical Fiber Communication Systems", IEEE J. of Lightwave Technology 10(1),pp96 (1992)